REMARKS

Claims 1-15 are pending in the application.

Claims 1-7 are rejected

Claims 8-15 are objected to.

Claims 1-6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Herden et al. (US Patent 6130535) and Arinaga et al. (US Patent 6061499).

Claim 7 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Herden et al. (US Patent 6130535) and Arinaga et al (US Patent 6061499) as applied to claims 1-6 above, and further in view of Lohberg et al (US Publication 20040066183).

Claims 8-15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form.

The Applicants traverse the rejections and request reconsideration.

Claim Amendments

Claim 7 has been amended to place it in an independent form more acceptable under US patent practice.

Claim Rejections Under 35 U.S.C. 103(a)

Rejection of Claims 1 - 6 as being unpatentable over Herden et al. and Arinaga et al.

The present invention (as recited in claim 1) requires a magnetic encoder that includes a permanent magnet. The permanent magnet is required to be fixed to a rotating body. A magnetic field detecting element is fixed to a fixed body. The magnetic field element is required to face the permanent magnet through an air gap. The rotating body is required to have a ring shape. The permanent magnet is also required to have a ring shape and is further required to be fixed to an inner circumferential side of the rotating body. The permanent magnet is magnetized

in parallel to a direction perpendicular to a center axis of the rotating body. The fixed body is required to have a circular outer circumference and a cavity. The fixed body is disposed at an inner circumferential side of the permanent magnet. **The magnetic field detecting element is required to be disposed on an outer circumferential side of the fixed body.**

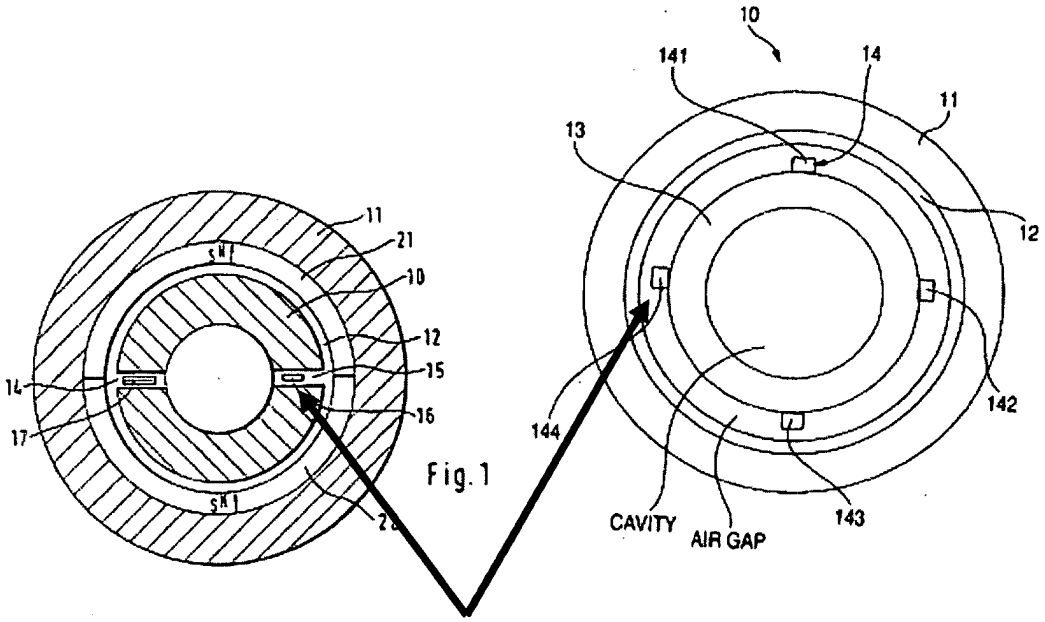


Fig. 1 of Herden is reproduced above on the left and Fig. 1 of the present Specification is presented above on the right. The Examiner reads the rotating body on the rotor 11 of Herden and the fixed body on the stator 10 of Herden. The permanent magnet is read on items 21 and 22. As shown in the figure, the permanent magnet has a ring shape and is fixed to the rotor 11. The Examiner reads the magnetic field detecting element on the Hall element 16 of Herden.

The Applicants respectfully submit that, while the present invention requires the magnetic field detecting element to be disposed on an outer circumferential side of the fixed

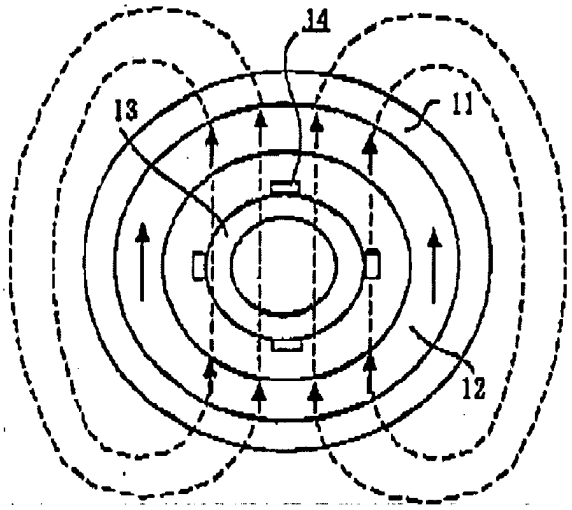
body, the Hall element of Herden is not positioned on the outer circumferential side of the stator. This deficiency in Herden is not cured by the secondary reference Arinaga.

The above distinction is believed to be very technically significant. Because of the above structural difference, a difference is caused in waveforms of a detection signal and in detection ranges of a rotating position providing significant advantages to the present invention. Namely, in the present invention, it is possible to realize a magnetic encoder device having an absolute value type cavity structure which can obtain a detection signal that changes in a sine waveform with respect to a rotation of a rotating body and can detect all rotating positions of the rotating body by using the signal.

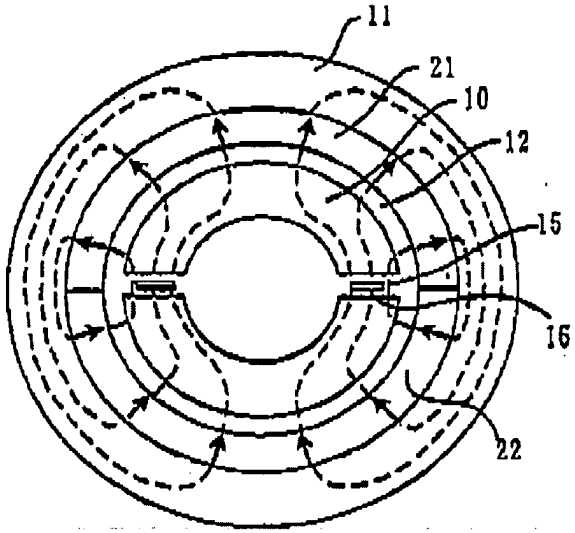
On the other hand, in Herden, although a detection signal that changes linearly with respect to a rotation of a rotating body can be obtained, all rotating positions of the rotating body can not be detected.

The above-discussed difference is specifically explained with referring to Drawings 1 (a) and 1(b) as follows.

Drawing 1 (a) shows a configuration of a magnetic encoder according to the present invention, and Drawing 1(b) shows a configuration of a detecting device in Herden. In Drawings 1 (a) and 1 (b) , arrows show magnetization directions of the respective permanent magnets. Further, dotted lines show appearance of assumed magnetic lines, and show state of assumed magnetic fields thereof.



Drawing 1(a)



Drawing 1(b)

Regarding the permanent magnet, the Applicants respectfully submit that the present invention and Herden differ in a magnetization state of a permanent magnet and also differ in a magnetic field state formed by this.

As shown in Drawing 1(a), the permanent magnet 12 in the present invention has a ring shape, is inscribed in and fixed to an inner circumferential side of the rotating body 11 and magnetized in parallel to a direction perpendicular to a center axis of the rotating body 11.

On the other hand, as shown in Drawing 1 (b), the permanent magnet 21 in Harden is constituted by a pair of semicircular magnets 21, 22, and magnetized in a radial direction. Therefore, magnetization directions of the semicircular magnets 21, 22 are opposite to each other. Namely, if an N pole of the semicircular magnet 21 is located inside the rotor 11, an S pole of the semicircular magnet 22 is located inside the rotor 11,

Thus, the present invention and Herden significantly differ in a magnetization state of the permanent magnet. The permanent magnet in Herden is not magnetized in parallel to one direction.

Further, there is a significant difference in arrangement of a magnetic field detecting element.

The magnetic field detecting element 14 in the present invention is disposed on an outer circumferential side of the fixed body 13 through the permanent magnet 12 and the air gap. On the contrary, the hall element 15 in Herden is disposed in the slit-like air gap 15 of the stator 10 formed by magnetic material.

This causes difference in a detection waveform of the magnetic field detecting element.

Firstly, because of the above structure, a sine wave signal is obtained in the present invention. In the present invention, as described above, nearly parallel magnetic fields are formed on an inner circumferential side of the permanent magnet 12 as shown by the dotted line in Drawing 1(a). Meanwhile, magnetic line is shown on the assumption that the rotating body 11 and the fixed body 13 are non-magnetic. However, even if the rotating body 11 and the fixed body 13 are magnetic, it is believed that nearly parallel magnetic fields are formed in the gap, in which the magnetic field detecting element is disposed, at an inner circumferential side of the permanent magnet 12, in the same manner as in the case of non-magnetic. Then, although the magnetic field detecting element 14 is disposed on an outer circumferential side of the fixed body 13, since the fixed body 13 is disposed on an inner circumferential side of the permanent magnet 12, it means that the magnetic field detecting element 14 is disposed in the parallel magnetic field. If the rotating body 11 rotates, a magnetic field also rotates, and strength of the

magnetic field with respect to the magnetic field detecting element 14 changes in a sine waveform.

For example, assuming that a direction of the magnetic field accords with a magnetically sensitive direction of the magnetic field detecting element 14 and a magnetic field H is applied to the magnetic detecting element 14 at a certain rotating position, strength of the magnetic field in the magnetically sensitive direction of the magnetic field detecting element 14 at the time that the rotating body has rotated from this position by θ becomes $H \cdot \cos\theta$. Namely, in the present invention, it is possible to obtain one cycle sine wave detection signal from the magnetic field detecting element 14 with respect to one rotation of the rotating body 11.

Then, the magnetic field detecting elements are disposed on an outer circumferential side of the fixed body at an interval of 90° , to generate signals Va and Vb that are different by a phase of 90° on the basis of a detection signal of the magnetic field detecting element. Therefore, it is possible to realize an absolute value type magnetic encoder that can specify rotational angles at all positions within one rotation with using these signals. Meanwhile, a skilled artisan will know how to obtain a rotational angle A by calculating tan-1 (Va/Vb) using the signals Va and Vb. This is also described in the paragraph [0010] in the present specification.

On the other hand, a detection signal waveform in Herden is completely different. The hall element 16 in Herden is disposed in the slit-like air gap 15 of the stator 10 which is magnetic. A direction of a magnetic field in the gap 15 does not rotate together with a rotation of the rotating body as in the present invention and becomes nearly upward and downward, two directions of a page space, so that strength of the magnetic field changes linearly with respect to a rotational angle. As a result of this, in Herden, if the rotor 11 rotates, magnetic flax density of the gap 15 of the fixed body 10 changes linearly according to the rotation, and it is possible

merely to obtain a detection signal that changes (increases or decreases) linearly from the hall element.

At an increasing or decreasing changing point of the signal that increase or decreases linearly, there is a portion where a detection signal changes slowly. Therefore, in Herden, except for this portion, a signal of a portion changing linearly is used to detect a rotating position of the rotating body. Clearly, it is not possible to detect rotational angles at all positions within one rotation as in the present invention.

Thus , the specific claimed structure of the present invention provides significant advantages over Herden in that it is possible to realize a hollow magnetic encoder by the configuration thereof and it is possible to realize an absolute value type magnetic encoder that can **specify rotational angles at all positions within one rotation**.

Therefore, the Examiner is incorrect in completely ignoring the structural differences between the present invention and Herden. A skilled artisan would not have found it obvious to make the present invention from the alleged teachings of Herden. In fact, as explained clearly above, by having a different structure, Herden is teaching away from the present invention as the effects on the waveforms are very different producing completely different effects on the functionality.

Claims 2-6 are dependent on claim 1 and are allowable at least for the same reasons.

Rejection of Claim 7 as being unpatentable over Herden et al. and Arinaga et al. as applied to claims 1-6, and further in view of Lohberg et al.

Claim 7 includes limitations analogous to claim 1. Therefore, the arguments presented above are analogously valid.

Objection of Claims

The Applicants request the Examiner to hold the objections to claims 8-15 in abeyance pending resolution of the status of claim 7.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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Respectfully submitted,

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